

NON-PUBLIC?: N
ACCESSION #: 8810280304
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Byron, Unit 2 PAGE: 1 OF 3

DOCKET NUMBER: 05000455

TITLE: REACTOR TRIP ON 2C STEAM GENERATOR LOW LEVEL DUE TO A
FEEDWATER PUMP
TRIP AND FAILURE OF DIGITAL ELECTROHYDRAULIC CONTROL SYSTEM
TO RUNBACK
TURBINE
EVENT DATE: 02/12/88 LER #: 88-001-01 REPORT DATE: 10/19/88

OPERATING MODE: 1 POWER LEVEL: 094

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: T. Joyce, Assistant Superintendent Operating Ext. 2213

TELEPHONE: (815) 234-5441

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: JJ COMPONENT: V MANUFACTURER: M423
REPORTABLE TO NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On February 12, 1988, at 1804 hours with Byron Unit 2 in power operation (Mode 1) at 94% power, the 2C feedwater pump tripped on overspeed. Efforts to shed load were unsuccessful due to failure of the digital electrohydraulic control system to respond properly in the automatic mode. This resulted in loss of inventory in the steam generators and a reactor trip on low steam generator level. All safeguard actuation features functioned as designed. The feedwater pump trip was due to a failed servovalve which allowed the feedwater pump turbine high pressure governor valve to fail open. This caused the pump overspeed and trip. The defective servovalve was replaced. There have been previous reactor trips due to feedwater pump trips.

END OF ABSTRACT

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A. PLANT CONDITIONS PRIOR TO @VENT:

Event Date/Time 2-12-88 / 1804

Unit 2 MODE 1 - Power Operations Rx Power 94% RCS AB!
Temperature/Pressure Normal Operating

B. DESCRIPTION OF EVENT:

On February 12, 1988, at 1804 hours, Byron Unit 2 was in power operation (Mode 1) at 94 percent power. The Digital Electrohydraulic (DEH)TG! control system was maintaining the turbine generator at 1070 MWe in Auto with Impulse and Speed feedback loops "IN" and Megawatt Feedback loops "OUT". At this time the 2C Turbine Driven Feedwater pump (FW)SJ! tripped due to overspeed. The Nuclear- St&Lion Operator (NSO, Licensed) correctly initiated a runback of the Main Turbine Generator (TG)TB!. The ramp was programmed for 2000 MWe/min to 559 MWe per Byron Operating Procedures. The DEH Computer did not execute the runback properly and load only dropped 60 MWe and held at 1014 MWe. The operator depressed the "HOLD" button and the ramp was re-initiated in the manual control mode. The Turbine Generator runback was not sufficient and a "low low" level in the 2C Steam Generator caused a reactor trip. The Unit was maintained in Mode 3, Hot Standby, until initial investigations of the turbine runback failure and feedwater pump trip were conducted. The NRC was notified at 1853 hours on 2/12/88.

Unit 2 was brought back on line using the 2B Turbine Driven Feedwater pump in place of the 2C Feedwater pump. The high pressure governor on the 2C Feedwater pump was manually isolated upstream to allow monitoring of the 2C Feedwater pump governor valve without affecting pump operation. The go
ernor valve's servo-actuator valve was replaced and was being monitored at seven different points by a strip chart recorder.

All safety systems responded as required. No other systems or components were inoperable prior to this event which contributed to this event. All operator actions were correct. This event is reportable pursuant 10CFR50.73 (a)(2)(iv).

On 2/22/88, at 0130 hours, Unit 2 was in Mode 1 at 86 percent power when the High Pressure Governor valve on the 2C Turbine Driven Feedwater Pump opened. The valve was being monitored following the replacement of the servo-actuator valve, and the steam supply was manually isolated. The Unit

experienced no adverse affects from this occurrence.

C. CAUSE OF EVENT:

The cause of the 2C Feedwater pump trip on February 12, 1988, was found to be a failure of the servovalve on the High Pressure Governor Valve. The High Pressure Governor Valve on the Feedwater Pumps are only used at startup and shutdown. When the servovalve failed, the High Pressure Governor Valves failed open causing the Feedwater Turbine to overspeed and trip. The failure report from the manufacturer of the failed servo valve showed the cause to be internal damage within the valve. The valve flapper was grooved and numerous valve internal components were damaged. Also, the null bias was out of adjustment. The majority of the problems with the valve can probably be attributed to the EH fluid which caused numerous servo valve failures on both the Feedwater Pumps and the main turbine. Failure reports from MOOG (the valve manufacturer) indicated similar failures with all the valves examined.

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C. CAUSE OF EVENT: (Continued)

The Feedwater pump trip required the Unit 2 NSO (licensed) to initiate a turbine runback which did not occur as planned. Previously, changes were made per Westinghouse instructions and in accordance with the Station's software control program to the DEH computer, in order to fine tune the main turbine governor valve operations. These changes were made to minimize load swings during governor valve testing. One of the changes made to the DEH computer involved reducing the deadband for the impulse pressure Feedback loop by adjusting some of the computer gains. Basically, this loop looks at a calculated impulse pressure. If the difference between the calculated impulse pressure and the actual impulse pressure is too great the DEH computer rejects the impulse pressure loop and stops the unit at that power level. The turbine runback, initiated after the 2C Feedwater Pump trip, dropped electrical output approximately 60 MWe when the gain value between calculated and actual impulse pressure was exceeded, halting the runback. The runback was completed manually.

On 2/22/88 the failure of the replacement servovalve was determined to be the cause of the High Pressure Governor Valve opening. In this event there were no adverse affects to the Unit due to the fact that steam to the High Pressure Governor Valve was isolated. The servovalve was found to have a defective coil with high internal resistance. In the first event the cause of the servovalve failure was not apparent.

D. SAFETY ANALYSIS:

All plant safety systems actuated and performed as designed. The reactor tripped on Low-2 level on the 2C Steam Generator. The Manual Turbine Generator runback was still available to runback the Turbine.

E. CORRECTIVE ACTIONS:

The servovalve was replaced on the 2C Feedwater Pump High Pressure Governor Valve after the 2/12/88 occurrence. The second High Pressure Governor Valve failure was being monitored and examination of the strip chart recordings showed that the servovalve was again malfunctioning but with a different mode of failure. The servovalve was again replaced after the 2C Feedwater Pump was taken off line, and the 2A Motor Driven pump was put into service. The 2C pump was monitored following component replacement, and will continue to be monitored when it is returned to operation to ensure proper operation. The DEH Software problem was resubmitted to Westinghouse Corporation for reevaluation. In the interim the gains in the DEH computer will be returned to their previous values. Subsequent valve tests have been conducted with satisfactory results. Unit 2 is currently operating the EH System with both Fuller's Earth and corrugated Cellulose filters in service at all times to maintain the fluid within its specifications.

F. PREVIOUS OCCURRENCES:

Previous reactor trips due to Feedwater pump trips were reported in the following LER's.

LER NUMBER TITLE

454/85-061-01

454/87-018-00

455/87-009-00

G. COMPONENT FAILURE DATA:

a) MANUFACTURER NOMENCLATURE MODEL NUMBER MFG PART NUMBER

Moog Servovalve A076-185 1161

Moog Model 760

b) RESULTS OF NPRDS SEARCH

No pertinent information found during NPRDS search.

ATTACHMENT 1 TO 8810280304 PAGE 1 OF 1

CE Commonwealth Edison
Byron Nuclear Station
4450 North German Church Road

Byron, Illinois 61010

October 19, 1988

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Dear Sir:

The enclosed Licensee Event Report from Byron Generating Station is being transmitted to you as a Supplemental Report.

This report is number 88-001; Docket No. 50-455.

Sincerely,

R. Pleniewicz
Station Manager
Byron Nuclear Power Station

Enclosure: Licensee Event Report No. 88-001-01

cc: A. Bert Davis, NRC Region III Administrator
P. Brochman, NRC Senior Resident Inspector
INPO Record Center
CECo Distribution List

Ltr: BYRON 88-1098 (1917M/0206M)

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